



Biology: uniformity and diversity

Spiders' Webs

Fritz Vollrath

It is wonderful structures. And there are very few examples where you can study animal engineering on that kind of level of resolution.

Now this one is 'Nephila senegalensis' from Africa. It's a pretty big spider. It's called 'The Golden Orb Spider', because the silk is quite yellowish, golden. Up there, you can see the male, which is a dwarf male. Much, much smaller than the female, often cohabits with the female. The web itself it an orb web, consisting of a hub, from which the spokes radiate outwards. And then overlaid on that, are two spirals. You can't see really see that very well. Let me spray it a bit more, and maybe if you focus in on it, you can see that there are some very sticky threads in there. It's a very tight web. You can see it's very tight. And some of the threads are extremely strong. You can see here how strong they are. This is of course many threads bound together into a fibre.

Narrator

An intriguing idea is that these complex structures result from the repeated application of simple behavioural rules.

Fritz Vollrath:

A spider is a pretty simple animal really. It has a pretty small brain and it has a few rules that it uses to build its web.

Narrator:

Digitized images of a garden cross web show the different threads as they're laid down. And also the movement patterns of the spider itself.

Fritz Vollrath

It's moving the hub around now, the centre of the web, and it really shifts around a little bit. Until it's more or less in the right position, where the spider likes it to have in this framework of sticks. And now it's building the radials, which are the dragline silk. And let me just stop it briefly here. And it is just started with the auxiliary spiral, which is there to bind these radial spokes together in a very tight loop. And you see the straight lines of the thread and the wiggles of the movement pattern of the spider. And this is very interesting, because it actually shows that the rules that the spider uses are there to make threads. And the detours are just detours. And of course if we didn't have the threads, but just the track of the spider, we couldn't really analyse it very well.

Narrator

The auxiliary spiral is made from dry silk, and built from the inside out. The spider uses sticky silk to build the capture spiral that completes the web.

Fritz Vollrath

And whilst it's building this spiral from the outside in, it is actually cutting away the auxiliary spiral. Which in a way it's a handrail for building. In this particular web our garden spider not required for catching.

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